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Steady 3D thermocapillary flow and dryout inside a V-shaped wedge LI YANG, G.M. HOMSY, Department of Mechanical and Environmental Engineering, University of California, Santa Barbara — We consider a liquid meniscus inside a wedge of included angle 2β that wets the solid walls with a contact angle θ. Under an imposed axial temperature gradient, the Marangoni stress moves fluid toward colder regions while capillary pressure gradients drive a reverse flow, leading to a steady state. Two curvatures contribute to the capillary forces: the axial curvature along the flow direction z and the transverse curvature of the circular arc inside the cross section perpendicular to the flow axis. Lubrication theory is used to derive a thin film equation for the shape of the interface. Solutions are governed by two parameters: D, a geometric parameter giving the relative importance of the two curvatures and M, a modified Marangoni number. Numerical solutions indicate that for sufficiently large M, the Marangoni stress creates a virtual dry region. The value of M at dryout is found to depend linearly on D. A simplified analytical model is developed which agrees very well with the exact solution for large values of D. It is found that dryout occurs more easily for larger wedge angle and/or contact angle.

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